Paper Roll Support Device

Background of the Invention

1. Field of the invention

The present invention relates to a paper roll support device in a feeding unit of a rotary press. In more detail, this invention relates to a paper roll support device in a feeding unit constructed so that both ends of an inner tube of a paper roll are supported by opposing support members in such a way as to be rotated and rotatably braked together with the paper roll support device by contact force between the support members and the inner tube.

2. Description of the Related Art

Conventionally, a paper roll support device for supporting a paper roll in a feeding unit of a rotary press by both sides of an inner tube of the paper roll is well known, as disclosed, for example, in Japanese Patent Laid-open No. Hei. 6-115786 (related art 1) and Japanese Examined Patent publication No. Hei. 6-74104 (related art 2).

Related art 1 comprises rolling centers, provided at tips of a plurality of pairs of opposed arms provided on the rotational axis of a feeding unit, for supporting both sides of inner tubes of the paper rolls in an axial direction so as to be capable of rotation, means for detecting rotation of the rolling centers, means for detecting travel caused by drawing out of the paper roll, means for comparing signals from the two detection means to determine presence or absence of slip between a roll source sheet and the rolling centers, and means for controlling pressing drive of the rolling centers based on results from the determining means.

As the control, a signal representing detection of rotation of the rolling centers and a signal representing detection of travel of the roll source sheets are treated as relational operators and slip between the rolling centers and the roll source sheets is detected, and if there is slip, fastening force of the rolling center towards the paper roll (contact force) is increased to prevent slip.

Also, related art 2 comprises a pair of rotatable end holders for holing an inner tube of a paper roll from both sides, a casing for holding one of the end holders so as to be capable of moving backwards and forwards, a pinion engaging with a rack provided in the casing, a worm wheel provided in the pinion, an air motor having a worm for engaging with the worm wheel

provided on an output shaft, a pressurized air supply source side pressurized air supply line, a first pressure reduction valve provided in the pressurized air supply source side pressurized air supply line, a pressurized air supply line for advancing the end holders and a pressurized air supply line for reversing the end holders on the air motor side, a first three-way valve for connecting these pressurized air supply lines for advancing and reversing the end holders, a second three-way valve provided in the middle of the pressurized air supply line for advancing the end holders, a bypass air line for bypassing the first three-way valve and the first pressure reduction valve to connect the second three-way valve to the pressurized air supply source side pressurized air supply line, a forward and reverse drive unit for the end holders made up of a second pressure reduction valve provided to set the pressure of the bypass air line to a lower pressure than the first pressure reduction valve, and a control unit for controlling the other end holder.

With the second related art, when a paper roll is mounted, air at a pressure set by the first pressure reduction valve is supplied to the air motor to increase contact force between the paper roll and the end holders, and when operating a rotary press, the second three-way valve is switched to supply air at a pressure set by the second pressure reduction valve to the air motor and the contact force between the paper roll and the end holders is reduced.

The device disclosed in related art 1 has control means for comparing a rotation detection signal for rolling centers and a travel speed detection signal for the roll source for all speeds to determine whether or not there is slip between the inner tube of the roll source and the rolling center, and for controlling pressing drive of the rolling center to prevent the slip, and because drive is carried out to increase contact force so as to stop the slip between them after slip arises, abrasion occurs at where surfaces of the inner tube of the roll source and the rolling centers contact each other. For example, if operation has progressed to where the roll paper is being pulled out at high speed and is then suddenly stoppe
d, since slip occurs, there will be a large time lag until slippage is cancelled, and as a result abrasion occurs at contact surfaces of the inner tube of the roll source and the rolling centers.

Also, with the related art 2, force with which the two sides of the inner tube of the paper roll are pressed by the end holders at the time of

operation is smaller than the force when mounting the paper rolls. This pressing force does not change under any conditions, such as at the time of operation, a sudden stop and if there is a large difference in the diameters of paper rolls.

Accordingly, when contact force between the paper rolls and the end holders at the time of operation of a rotary press is smaller than a large force acting between the inner tube rotated by inertial force at the time of sudden stop, and the end holders stopped after deceleration by braking, slip occurs between the inner tube and the holders in the rotation direction at the time of sudden stop, resulting in abrasion of the contacting sections. Also, when contact force between the paper rolls and the end holders at the time of operation of a rotary press is larger than the large force acting between the inner tube and the end holders at the time of sudden stop, since a large force always acts between the inner tube and the end holders, there is usually a large load acting on a bearing section for supporting the inner tube in a rotatable manner, which reduces the lifespan of the bearing, and as a result the durability of the paper roll support device is degraded.

SUMMARY OF THE INVENTION

This invention is directed to a paper roll support device for supporting a paper roll, as well as enabling rotation and rotation braking together with the paper roll, having a pair of support means capable of supporting both sides of an inner tube of a paper roll, and pressure change assigning means, capable of reciprocating in the direction of another opposing support means, and providing pressure to at least one support means to cause movement in a direction reducing a distance between the pair of support means, as well as being capable of selectively changing and assigning pressure of at least two magnitudes for carrying out movement in a direction so as to reduce a distance between a pair of support means, wherein in the event of a sudden stop of a rotary press, it is possible to increase contact force between the support means and the inner tube of the paper roll by increasing pressure to cause movement in a direction to reduce a distance between a pair of support means.

The object of the present invention is to prevent abrasion in a rotation direction between contacting sections of an inner tube of a paper roll and support members for supporting the paper roll, under normal operating

conditions and at the time of emergency stop, by changing contact pressure for support members opposing the inner tube of the paper roll when supporting the paper roll between a normal running contact pressure for arriving at a stop state from normal rotational drive, and an emergency stop contact pressure that is sufficiently larger than the normal running contact pressure.

It is a further object of the present invention to prevent a large load always acting on a bearing section for supporting the support members in a rotatable manner so as to improve durability of the paper roll support device.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an overall schematic block diagram of paper feeding section provided in a paper roll support device of an embodiment of the present invention.

Fig. 2 is an explanatory drawing showing the overall structure of a paper roll support device, and is a cross section along line X - X in Fig. 1 of the paper roll support device of an embodiment of the invention.

Fig. 3 is a partially enlarged cross section of the paper roll support device of Fig. 2, showing the state of first support means having one support member before fitting a paper roll.

Fig. 4 is a partially enlarged cross section of the paper roll support device of Fig. 2, showing the state of first support means having one support member after fitting a paper roll.

Fig. 5 is a partially enlarged cross section of the paper roll support device of Fig. 2, showing the state of second support means having another support member before fitting a paper roll.

Fig. 6 is a partially enlarged cross section of the paper roll support device of Fig. 2, showing the state of second support means having another support member after fitting a paper roll.

Fig. 7 is a drawing in the direction of arrow Y in Fig. 3 and Fig. 5, showing a tip front of a support member.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Embodiments of the present invention will now be described based on the drawings. Fig. 1 is an overall schematic block diagram of a paper feeding section provided in a paper roll support device of an embodiment of the present invention, Fig. 2 is an explanatory drawing showing the overall structure of a paper roll support device, and is a cross section along line X - X in Fig. 1 of the paper roll support device of an embodiment of the invention, Fig. 3 is a partially enlarged cross section of the paper roll support device of Fig. 2, showing the state of first support means having one support member before fitting a paper roll, Fig. 4 is a partially enlarged cross section of the paper roll support device of Fig. 2, showing the state of first support means having one support member after fitting a paper roll, Fig. 5 is a partially enlarged cross section of the paper roll support device of Fig. 2, showing the state of second support means having another support member before fitting a paper roll, Fig. 6 is a partially enlarged cross section of the paper roll support device of Fig. 2, showing the state of second support means having another support member after fitting a paper roll, and Fig. 7 is a drawing in the direction of arrow Y in Fig. 3 and Fig. 5, showing a tip front of a support member.

Fig. 1 and Fig. 2 show a feeding unit provided with the paper roll support device S that is one embodiment of the present invention. The feeding unit has an arm rotational axis H supported between opposing plates T, T that are spaced apart, and rotational drive means (not shown in the drawing) are connected to the arm rotational axis H. Also, a pair of a first arm J1 and a second arm J2 are provided on the arm rotational axis H in an opposed manner, with the respective first arm J1 and second arm J2 being attached so as to be capable of moving together in the axial direction of the arm rotational axis H, thus making it possible to adjust distance in response to the width of two paper rolls R1, R2 mounted between the first arm J1 and the second arm J2. In Fig. 1, W is a traveling paper web and L is a paper roll conveying unit.

The paper roll support device S that is one embodiment of the present invention comprises first support means A for supporting a paper roll R1, respectively provided close to the ends of both sides of the first arm J1, movement positioning means B, braking means C, and second support means D for supporting the paper roll R1, respectively provided close to the ends of both sides of the second arm J2, and pressing means E linking to the

respective second support means D.

The upper paper roll R1 in Fig. 2 is shown in a state before being mounted on the paper roll support device S, while the lower paper roll R2 is shown in the normal operating state being mounted on the paper roll support device S.

In the feeding unit, a paper web W pulled out from the paper roll R2 mounted on the paper roll support device S travels while being subjected to adjustment control of travel tensioning force, and after printing in a printing section (not shown), is cut in a folding section (not shown) to give a printed article that is folded.

Next, a description will be given of the first support means A of the paper roll support device S of this invention. As shown in Fig. 2, Fig. 3 and Fig. 4, the first support means A are provided close to the tip on both sides of the first arm J1, and are provided at a position opposite second support means D provided close to tips of both sides of the second arm J2.

As shown in Fig. 3 and Fig. 4, the first support means A comprises a first support member 1 and a first sleeve 2, and a first bearing 20 is provided between the first support member 1 and the first sleeve 2 for supporting the first support member 1 in a rotatable manner with respect to the first sleeve 2.

The first support member 1 is made up of a first rotating shaft 10, a first stopper 11, a first contact member 12, a first spring holder 13, a first compression spring 14, a first flange section 15, and a first insertion section 16.

The first sleeve 2, is provided so as to be capable of moving in an axial direction of the arm rotation shaft H within a first hole 21 provided passing through a tip part of the first arm J1 along the axial line of the arm rotation shaft H. The first sleeve 2 is provided being regulated so as not to rotate with respect to the first hole 21 by a first key member 22 provided between the first sleeve 2 and the inner wall of the first hole 21. The first sleeve 2 is also fitted so as to move in the axial direction of the arm rotation shaft H in accordance with the first support member 1, using the movement positioning means B.

The first support member 1 has a substantially central part of the first rotating shaft 10 rotatably supported at an inner wall of the first sleeve 2 via the first bearing 20. Both ends of the first rotating shaft 10 of the first support member 1 project from the first sleeve 2. The first flange section 15

is provided on the first rotating shaft 10 close to an end surface of the first sleeve 2 of a section projecting from the first sleeve 2 to a side where the paper roll R is positioned, and a cylindrical first insertion section 16 is formed projecting from the first flange section 15 to the side where the paper roll R is positioned.

A first stopper 11 having a thin truncated cone shape becoming smaller in outer diameter towards the tip so as to be easy to insert into an inner tube K of a paper roll R is attached to the tip of the first insertion section 16. Also, as shown in Fig. 3, Fig. 4 and Fig. 7, first inclined grooves 160 are formed in the first insertion section 16 at a plurality of places on the outer surface, in this embodiment at four places at intervals of 90 . The first inclined grooves 160 are formed as grooves having an inclined surface so as to become gradually shallower in the radial direction and facing to the first flange section 15 side from respective tips. The respective first inclined grooves 160 are formed with a slit shaped slit groove 160a at the surface side of the insertion section 16, and a dovetail groove 160b having a wider dovetail shape than the slit groove 160a is formed in a groove bottom surface connecting to the slit groove 160a.

The first contact member 12 engages with the respective first inclined grooves 160 so as to be capable movement in the groove direction of the first inclined grooves 160, upper sections (surface side) 12a of the first contact member 12 engage with the groove surface side slit grooves 160a, and a dovetail section 12b, being a base section (central side) of the first contact member 12 being formed in a cross sectional shape corresponding to the groove shape of the dovetail groove 160b, engages with the groove bottom surface side dovetail groove 160b. The first contact member 12 is prevented from coming off the first inclined grooves 160 by the engagement of the dovetail section 12b and the dovetail groove 160b, and can also reciprocate along the first inclined grooves 160.

Respective first contact members 12 are made up of an erected section 120 formed at the first flange section 15 side, and a base section 121 formed at the first stopper 11 side, and have steps. The first contact member 12 varies a distance from the center line of the first insertion section 16 in accordance with reciprocation along the first inclined grooves 160, but the erected section 120 projects from the slit grooves 160a no matter what position it is at, and the base section 121 is capable of appearing from the slit

grooves 160a. That is, the base section 121 projects further from a cylindrical surface of the first insertion section 16 as the first contact member 12 moves to the first flange section 15 side, and conversely sinks into the slit grooves 160a as the first insertion section 16 moves towards the first stopper 11 side.

As a result, the first insertion section 16 is inserted into the inner tube K of the paper roll R, and if the first contact member 12 is pressed to move towards the first flange section 15 by the end surface of the inner tube K, the base section 121 of the first contact member 12 projects from the first inclined grooves 160 and an outer surface comes into contact with an inner surface of the inner tube K. The contact force between the outer surface of the base section 121 and the inner surface of the inner tube K then becomes large as the first contact member 12 approaches the first flange section 15 side.

The outer surface of the base section 121 of the first contact member 12 is formed by suitable surface processing and/or in a suitable shape to have high frictional force. Respective first contact members 12, in a non-load state, are pressed against the first stopper 11 by action of the first compression spring 14 provided between the first spring holder 13 fixed to a side surface of the erected section 120 of the first contact member 12, at the first flange section 15 side, and the first flange section 15, and in this state the base sections 121 of the respective first contact members 12 sink into the slit grooves 160a.

A rear shaft section 100 linked to the braking means C is provided on another end of the first rotating shaft 10 projecting from the first sleeve 2 to the opposite side to the first contact member 12.

Next, a description will be given of the movement positioning means B of the paper roll support device S of the invention. The movement positioning means B, as shown in Fig. 3 and Fig. 4, comprises a rack 30 provided on the first sleeve 2 of the first support means A, a pinion 31, and a motor 32 attached to the first arm J1.

The rack 30 is formed singly on the outer surface of the first sleeve 2, parallel to the axial line of the first sleeve 2, and is fixed to the first sleeve 2. The pinion 31 is positioned on an inner surface of the first hole 21 so as to mesh with the rack 30 in a movable manner, and is attached to the first arm J1.

An output shaft of the motor 32 for rotatably driving the pinion 31 is

connected to the pinion rotation shaft 310 of the pinion 31 via a reduction gear mechanism.

Specifically, the pinion rotation shaft 310 linked to the output shaft of the motor 32 via the reduction gear mechanism is rotated by rotational drive of the motor 32. As a result of rotation of the pinion rotation shaft 310, the pinion 31 moves the first sleeve 2 in the axial direction via the rack 30 it is meshed with. As a result of movement of the first sleeve 2 in the axial direction, the first rotating shaft 10 of the first support member 1 supported by the first bearing 20 is moved in the first sleeve 2. The first support member 1 that moves as a result of movement of the first rotating shaft 10 can move between a support position for supporting a paper roll R, and a standby position where the paper roll R is not supported.

The movement positioning means B does not have to be provided on the first arm J1 for positioning of the first support means A. In this case, the first support member 1 of the first support means A is provided fixed at a support position for supporting the paper roll R, the paper roll R is moved by being pressed to the first support means A side by the second support means D, and the first contact member 12 of the first support member 1 comes into contact with and is pressed into the inside of the inner tube K of the paper roll R.

Next, a description will be given of the braking means C of the paper roll support device S of the invention. As shown in Fig. 3 and Fig. 4, the braking means C is provided at the opposite side to the position of the first contact member 12, with the first sleeve 2 at a central position, and comprises a brake section bearing 40, a rotation sleeve 42 for attachment to the first arm J1 via a bracket 41, a rotation disk 43 capable rotating integrally with the rotation sleeve 42 and attached to the outer surface of the rotation sleeve 42, and a brake pad 44 capable of braking rotation of the rotation disk 43 by pressing against the rotation disk 43.

The rotation sleeve 42 of the braking means C is provided to engage with the rear shaft section 100 linking to the first rotating shaft 10 and projecting from the first sleeve 2 to the opposite side to the first contact member 12, and as well as the rear shaft section 100 being capable of moving only in the axial direction of the rotation sleeve 42 due to the key member 101 provided between the rotation sleeve 42 and the rear shaft section 100, the rotation sleeve 42 is coaxial with the first rotating shaft 10

of the first support member 1 and is provided capable of rotating with respect to the bracket 41 via the brake section bearing 40.

The braking means C has the brake pad 44 gripping the rotation disk 43 from both sides, and as a result of braking rotation of the rotation disk 43 by contact with the two sides, rotation of the rear shaft section 100 is braked via the rotation sleeve 42, and also the rotation of the first support member 1 is braked.

Next, a description will be given of the second support means D of the paper roll support device S of the invention. The second support means D, as shown in Fig. 2, are provided in the vicinity of both tips of the second arm J2, and provided at positions corresponding to the first support means A provided close to both tips of the first arm J1.

As shown in Fig. 5 and Fig. 6, the second support means D is made up of a second support member 5 and a second sleeve 6, with a second bearing 60 for supporting the second support member 5 so as to be rotatable with respect to the second sleeve 6 being provided between the second support member 5 and the second sleeve 6.

The second support member 5 is made up of a second rotating shaft 50, a second stopper 51, a second contact member 52, a second spring holder 53, a second compression spring 54, a second flange section 55, and a second insertion section 56.

The second sleeve 6 is provided so as to be engaged with the second hole 61 in a manner capable of moving in an axial direction of the arm rotation shaft H provided close to the tip and passing through a tip part of the second arm J2 along the axial line of the arm rotation shaft H. The second sleeve 6 is provided being regulated so that it does not rotate with respect to the second hole 61 by a second key member 62 provided between the second sleeve 6 and the inner wall of the second hole 61. The second sleeve 6 is also fitted so that it moves in the axial direction of the arm rotation shaft H in accordance with the second support member 5, using the pressing means E.

The second support member 5 has part of the second rotating shaft 50 rotatably supported at an inner wall of the second sleeve 6 via the second bearing 60. One end of the second rotating shaft 50 of the second support member 5 that is opposite to the first support member 1 projects from the second sleeve 6. The second flange section 55 is provided on the second rotating shaft 50 close to an end surface of the second sleeve 6 of a section

projecting from the second sleeve 6 to a side where the paper roll R is positioned, and a cylindrical second insertion section 56 is formed projecting from the second flange section 55 to the side where the paper roll R is positioned.

A second stopper 51 having a thin truncated cone shape becoming smaller in outer diameter towards the tip so as to be easy to insert into an inner tube K of a paper roll R is attached to the tip of the second insertion section 56. Also, as shown in Fig. 5 Fig. 6 and Fig. 7, second inclined grooves 560 are formed in the second insertion section 56 at a plurality of places on the outer surface, in this embodiment at four places at intervals of 90 . The second inclined grooves 560 are formed as grooves having an inclined surface so as to become gradually shallower in the radial direction and facing to the second flange section 55 side from respective tips. The respective second inclined grooves 560 are formed with a slit shaped slit groove 560a at the surface side of the insertion section 56, and a dovetail groove 560b having a wider dovetail shape than the slit groove 560a is formed in a groove bottom surface connecting to the slit groove 560a.

The second contact member 52 engages with the respective second inclined grooves 560 so as to be capable of movement in the groove direction of the second inclined grooves 560, upper sections (surface side) 52a of the second contact member 52 engage with the groove surface side slit grooves 560a, and a dovetail section 52b, being a base section (central side) of the second contact member 52 being formed in a cross sectional shape corresponding to the groove shape of the dovetail groove 560b, engages with the groove bottom surface side dovetail groove 560b. The second contact member 52 is prevented from coming away from the second inclined grooves 560 by the engagement of the dovetail section 52b and the dovetail groove 560b, and can also reciprocate along the second inclined grooves 560.

Respective second contact members 52 are made up of an erected section 520 formed at the second flange section 55 side, and a base section 521 formed at the second stopper 51 side, and are stepped. The second contact member 52 varies a distance from the center line of the second insertion section 56 in accordance with reciprocation along the second inclined grooves 560, but the erected section 520 projects from the slit grooves 560a no matter what position it is at, and the base section 521 is capable of appearing from the slit grooves 560a. That is, the base section 521

projects from a cylindrical surface of the second insertion section 56 as the second contact member 52 moves to the second flange section 55 side, and sinks into the slit grooves 560a as the second contact member 52 moves towards the second stopper 51 side.

As a result, the second insertion section 56 is inserted into the inner tube K of the paper roll R, and if the second contact member 52 is pressed to move towards the second flange section 55 by the end surface of the inner tube K, the base section 521 of the second contact member 52 projects from the second inclined grooves 560 and an outer surface comes into contact with an inner surface of the inner tube K. The contact force between the outer surface of the base section 521 and the inner surface of the inner tube K then becomes large as the second contact member 52 approaches the second flange section 55 side.

The outer surface of the base section 521 of the second contact member 52 is formed by suitable surface processing and/or in a suitable shape to have high frictional force. Respective second contact members 52, in a non-load state, are pressed against the second stopper 51 by action of the second compression spring 54 provided between the second spring holder 53 fixed to a side surface of the erected section 520 of the second contact member 52, at the second flange section 55 side, and the second flange section 55, and in this state the base sections 521 of the respective second contact members 52 sink into the slit grooves 560a.

Pressing means E capable of moving the second sleeve 6 in the axial direction are provided on an opposite side of the second sleeve 6 to the second contact member 52.

Next, the pressing means E of the paper roll support device S of the invention will be described. As shown in Fig. 2, Fig. 5 and Fig. 6, the pressing means E comprises sleeve moving means 7, paper roll detachment and change-over means 8, and pressure change assigning means 9. The pressure change assigning means 9 comprises path change-over means 90, first fluid pressure setting means 91, and second fluid pressure setting means 92.

The sleeve moving means 7 is made up of a piston 70 and a cylinder 71. The piston 70 is fixed to an end surface of the second sleeve 6 opposite to the second contact member 52, and is provided making air-tight contact with an inner wall of the cylinder 71 attached to the second arm J2, and

capable of reciprocation in the axial direction of the second sleeve 6. The cylinder 71 is provided with two air-tight chambers 72a and 72b inside the cylinder 71 partitioned by the piston 70. Connection ports 73a and 73b for supplying and releasing respective fluid pressure are provided in the two air-tight chambers 72a and 72b.

The paper roll detachment and change-over means 8 has two fluid discharge ports 80, 81, and is also a fluid path switching device, such as a 5-port, 2-position electromagnetic switching valve, for changing fluid paths by causing movement of two pairs of movable fluid movement paths 82, 83 and 84, 85, in response to external instruction signals (a mount signal N and remove signal Q, described later), and is provided in a fluid path for connecting a fluid source M, being a fluid pressure supply source, with the two air-tight chambers 72a and 72b inside the cylinder 71.

The paper roll detachment and change-over means 8 can cause the paper roll R to be supported by the second support member 5, and is also capable of causing the paper roll R to be pushed towards the first support member 1 via the second support member 5, towards a position where the force is acting. When the paper roll R is pressed towards the first support member 1 and caused to move to the pressing operation position, the paper roll detachment and change-over means 8 changes path to the fluid movement paths 82 and 82 by a mount signal N, so that the fluid of the fluid source M is supplied via the paper roll detachment and change-over means 8 and the path change-over means 90 to the air-tight chamber 72a, and connects the fluid source M to the connection port 73a using the fluid movement path 82, and connects the connection port 73b to the fluid discharge port 80 via a third fluid path 95 provided between this connection port 73b and the paper roll detachment and change-over means 8, using the fluid movement path 83 that has been changed so that fluid in the air-tight chamber 72b is discharged using the moving piston 70.

In the event that the second support member 5 is not supporting the paper roll R but is moved to a standby position where it is not pressed, the paper roll detachment and change-over means 8 changes path to the fluid movement paths 84 and 85, as a result of a remove signal Q, so that fluid in the fluid source M is supplied via the paper roll detachment and change-over means 8 to the air-tight chamber 72b, and as well as connecting the fluid source M with the connection port 73b using the fluid movement path 85,

the connection port 73a and the fluid discharge port 81 are connected via the path change-over means 90 and the fluid movement path 84 that has been changed, so that fluid in the air-tight chamber 72a is discharged by the moving piston 70.

The path change-over means 90 making up the pressure change assigning means 9 causes two movable fluid movement paths to move and changes the fluid path in response to external instruction signals (mount signal N, emergency stop signal P, described later), and is a fluid path change-over device such as, for example, a 3-port, 2-position electromagnetic change-over valve. The path change-over means 90 is provided between a first fluid path 93, provided as a fluid path for connecting the connection port 73a of the air-tight chamber 72a of the cylinder 71 via the paper roll detachment and change-over means 8 to the fluid source M, and a separate second fluid path 94 is provided as a fluid path between the connection port 73a and the fluid source M. The path change-over means 90 has an operation of changing over two fluid paths for fluid supplied from the fluid source M to the connection port 73a, namely the first fluid path 93 for supplying fluid from the fluid source M through the paper roll detachment and change-over means 8, and the second fluid path 94 that does not use the paper roll detachment and change-over means 8.

The first fluid pressure setting means 91 making up the pressure change assigning means 9 is provided between the paper roll detachment and change-over means 8 for the first fluid path 93 and the fluid source M, is constituted by, for example, a pressure regulating valve, and sets pressure used in the first fluid path 93 at the time of normal operation. This set pressure is a pressure that makes it possible to obtain normal contact pressure such that there is no slip between the inner tube K of the paper roll R and the first contact member 12 and the second contact member 52 at the time of braking when stop is reached from deceleration carried out in a comparatively long time by braking means C at the time of normal stop.

The second fluid pressure setting means 92 making up the pressure change assigning means 9 is provided between the path change-over means 90 for the second fluid path 94 and the fluid source M, is constituted by, for example, pressure regulating valve, and sets pressure to be used in the second fluid path 94 at the time of emergency stop. This set pressure is a

larger pressure than the pressure used at the time of normal operation, and is a pressure that makes it possible to obtain contact pressure at the time of emergency stop that is sufficiently larger than the normal contact pressure. This means that there is no slip between the inner tube K of the paper roll R and the first contact member 12 and the second contact member 52, at the time of braking when stop is reached from deceleration in a short time by the braking means C at the time of an emergency stop in response to an accident such as a paper web breaking during operation of a rotary press.

Next, operation of the embodiment of the invention will be described. A paper roll R to be mounted is loaded onto the paper roll conveying unit L and conveyed to the paper roll support device S. The distance between the first arm J1 and the second arm J2 shown in Fig. 2 is larger than the width of the paper roll R. The paper roll R is moved to a position substantially coincident with a common axis of the first support member 1 of the first support means A provided at the tip of the first arm J1 and the second support member 5 of the second support means D provided at the tip of the second arm J2, with an axial line of the inner tube K of the paper roll R between the first arm J1 and the second arm J2, and brought to a stop. This stop position is conformed by a sensor (not shown).

Next, a mount signal N is output either automatically, from a paper roll replacement controller, or manually. This generated mount signal N is received by the motor 32 of the movement positioning means B, with respect to the first support means A, and received by the paper roll detachment and change-over means 8 and the path change-over means 90 with respect to the second support means D. As a result of generation and receipt of this mount signal N, the first support means A and the second support means D begin to move towards an operating position at almost the same time, and an operation to support the paper roll R begins.

Next, a description will be given of operation of the first support means A when the mount signal N is originated. As a result of operation of the motor 32 receiving the mount signal N, the pinion 31 attached to the pinion rotation shaft 310 linked to the output shaft of the motor 32 via the reduction gear mechanism is rotated, and the rack 30 engaging with the pinion 31, the first sleeve 2 to which the rack 30 is attached, and the first support member 1, the first sleeve 2 moves towards the paper roll R.

As a result of this movement, the first support member 1 is stopped at

a support position for supporting a predetermined paper roll R, and positioned using the reduction gear mechanism. That is, as a result of movement to the paper roll R side of the first support member 1, the first stopper 11 the first insertion section 16 and the base section 121 of the first contact member 12 are sequentially inserted inside the tube from one end section of the inner tube K of the paper roll R. Then, respective side surfaces of step sides of the erected section 120 of the first contact member 12 contact the end surface of the inner tube K, and also in that state the respective first contact members 12 are pressed against the end surface of the inner tube K and moved in the direction of the first flange section 15 along the first inclined grooves 160 of the first insertion section 16 against the spring force of the first compression spring 14. Accompanying this movement, the respective first contact members 12 are separated from the center line of the first insertion section 16, and the base sections 121 of the first contact members 12 project from the slit grooves 160a. Respective outer surfaces of the base sections 121 then come into contact with the inner surface of the inner tube K of the paper roll R. Movement of the first support member 1 towards the paper roll R stops at a predetermined support position. That is, the support position of the first support member 1 is a position where a side surface of the paper roll R should be located when the paper roll R is supported in a correct positional relationship with respect to the print center of a printing section, not shown, and is a predetermined design position calculated based on elements such as inner diameter of the inner tube K of the supported paper roll R, angle of inclination of the first inclined grooves 160, outer diameter of the base section 121 of the first contact member 12, etc.

Next, a description will be given of operation of the second support means D when the mount signal N is originated. The paper roll detachment and change-over means 8 and path change-over means 90 that have received the mount signal N respectively change the fluid movement paths to the state shown in Fig. 2. That is, fluid supplied from the fluid source M is set to a normal operating pressure by the first fluid pressure setting means 91 provided in the first fluid path 93, and supplied from the connection port 73a through the paper roll detachment and change-over means 8 and the path change-over means 90 to the inside of the air-tight chamber 72a.

If fluid is supplied into the air-tight chamber 72a, the piston 70

capable of moving inside the cylinder 71 is moved to the paper roll R side by this fluid pressure. As a result of movement of the piston 70, the volume of the other air-tight chamber 72b inside the cylinder 71 is reduced, and the fluid of the air-tight chamber 72b is discharged from the connection port 73b, through the third fluid path 95, and out of the fluid discharge port 80 of the paper roll detachment and change-over means 8.

The piston 70 is connected to the second sleeve 6, and the second rotation shaft 50 of the second support member 5 is rotatably supported on the second sleeve 6. Accordingly, as a result of movement of the piston 70 to the paper roll R side, the second sleeve 6 and second support member 5 are also moved towards the paper roll R side, and due to the second support member 5 pressing the inner tube K of the paper roll R the inner tube K of the paper roll R is pressed against the first support member 1. That is, as a result of movement of the second support member 5 to the paper roll R side, the second stopper 51, second insertion section 56 and the base section 521 of the second contact member 52 are inserted in that order into the inside of the tube from one end section of the inner tube K of the paper roll R. Then, side surfaces of step sides of erected sections 520 of respective second contact members 52 contact the end surface of the inner tube K, and also respective second contact members 52 are pressed to the end surface of the inner tube K in that state and moved in the direction of the second flange section 55 along the second inclined grooves 560 of the second insertion section 56 against the spring force of the second compression spring 54. Accompanying this movement, the respective second contact members 52 are moved away from the center axis of the second insertion section 56, and the base section 521 of the second contact member 52 projects from the slit grooves 560a. The outer surface of the respective base sections 521 then come into contact with the inner surface of the inner tube K of the paper roll R, and the contact force between the two surfaces becomes larger as the second contact member 52 approaches the second flange section 55 along the second inclined grooves 560.

Also, as a result of the pressing of the inner tube K of the paper roll R towards the first support member 1 by the second support member 5, for the first support member 1 also, contact force between the outer surface of respective base sections 121 of the first contact member 12 and the inner surface of the inner tube K of the paper roll R also becomes large. If

pressing force of the second support member 5 and reaction force of the first support member 1 are in equilibrium, movement of the second support member 5, second sleeve 6 and piston 70 stops.

At the point in time where movement of the piston 70 stops, the contact forces of the first contact member 12 and the second contact member 52 with respect to the inner surface of the inner tube K are both equal. Specifically, the pressure of fluid acting from the air-tight chamber 72a side on the piston 70 acts as a force for causing the respective erected sections 120 of the first contact member 12 to move towards the first flange section 15 via the inner tube K of the paper roll R, and also acts as a force for causing the respective erected section 520 of the second contact member 52 to move towards the second flange section 15. This force respectively presses the first contact member 12 and the second contact member 52 with a perpendicular component of force with respect to the inclined bottom surfaces of the respectively inserted first inclined grooves 160 and second inclined grooves 560, and in this way, a reaction force component of force equal to the force pressing the bottom surfaces and a reaction force opposite to this component of force, act mutually as contact force generated between the outer surface of respective base section 121, 521 and inner surface of the tube K by the expansion of the contact member 12 and 52. Accordingly, as the pressure of the fluid acting on the piston 70 from 72a side increases, so the contact force between the first contact member 12 and the second contact member 52 and the inner tube K increases.

With the embodiment of the invention shown in the drawings, at the time of normal operation, contact forces between the inner surface of both ends of the inner tube K of the paper roll R, and outer surfaces of respective base sections 121 of the first contact member 12 and outer surfaces of respective base sections 521 of the second contact member 52 is set to the same contact force as when mounting a paper roll R. For example, as shown in Fig. 2, at the time of normal operation mounting a paper roll R2, setting pressure of the first fluid pressure setting means 91 is a pressure that makes it possible to obtain normal contact pressure such that there is no slip between the inner tube K of the paper roll R and the outer surfaces of the respective base section 121 and base section 521 of the first contact member 12 and the second contact member 52 at the time of braking when stop is reached from deceleration carried out in a comparatively long time by

braking means C at the time of normal stop.

Also, at the time of emergency stop when some abnormality has arisen during normal operation, an emergency stop signal P is issued to the path change-over means 90. As a result of the emergency stop signal P, by changing the fluid movement paths inside the path change-over means 90, fluid that passes from the fluid source M through the first fluid path 93 at the time of normal operation, that is, fluid that is supplied through the first fluid pressure setting means 91, paper roll detachment and change-over means 8 and path change-over means 90 to the connection port 73a, is stopped. At the same time as this, fluid at a larger pressure that at the time of normal operation passing from the fluid source M through the second fluid path 94, that is through passing through the second fluid pressure setting means 92 that has been set to a larger pressure than the set pressure of the first fluid pressure setting means 91 and the path change-over means 90, is supplied to the connection port 73a. As a result of this larger fluid pressure than at the time of normal operation, the piston 70 is pressed further to the air-tight chamber 72a side than at the time of normal operation.

The set pressure of the second fluid pressure setting means 92 is a pressure that makes it possible to obtain contact force at the time of emergency stop that is sufficiently larger than the normal contact force such that there is no slip between the inner surface of the inner tube K of the paper roll R2 and the outer surfaces of respective base sections 121 and base sections 521 of the first contact member 12 and the second contact member 52, at the time of braking when a stop is reached from deceleration in a short time by the braking means C at the time of emergency stop.

In this way, the construction of the paper roll support device is such that, in a state where both ends of the inner tube K of the paper roll R2 are supported by the first support member 1 of the first support means A and the second support member 5 of the second support means D, contact force of the first support member 1 and the second support member 5 with respect to the inner tube K of the paper roll R2 can be obtained using mutual pressing force of the opposing first support member 1 and second support member 5 across the inner tube K of the paper roll R2. It is then made possible to easily carry out the change-over between the contact force at the time of normal operation and the larger contact force at the time of emergency stop.

Also, when removing the paper roll R from the paper roll support

device S, a remove signal Q from a paper roll detachment controller, not shown, is issued to the paper roll detachment and change-over means 8. By changing over the fluid movement paths 84 and 85 inside the paper roll detachment and change-over means 8 as a result of this remove signal Q, if fluid supplied from the fluid source M is supplied into the air-tight chamber 72b from the connection port 73b through the paper roll detachment and change-over means 8, the piston 70 is moved in a direction away from the paper roll R by that fluid pressure. As a result of this movement of the piston 70, fluid of the air-tight chamber 72a passes from the connection port 73a, through the path change-over means 90 and is discharged from the discharge port 81 of the paper roll detachment and change-over means 8. The fluid movement paths of the path change-over means 90 at this time are positioned in the paper roll R mounted state. As a result of movement of the piston 70 away from the paper roll R, the second sleeve 6 and second support member 5 then also move away from the paper roll R and the paper roll R is removed from the paper roll support device S.

The effects of this invention are as described in the following.

(1) Since it is possible to make contact force between a contact member of a support member and an inner tube of a paper roll large enough to prevent slip between the two at the time of emergency stop of a rotary press where a large force acts on contact sections of a support member for supporting the inner tube of the paper roll, at the time of emergency stop of the rotary press it is possible to prevent the occurrence of slip in a direction of rotation of the inner tube of the paper roll and contact sections of respective contact sections for supporting both ends of the paper roll. It is therefore possible to prevent abrasion of contact sections of the contact members.

(2) Also, since it is possible to make the contact force between a contact member of a support member and an inner tube of a paper roll the minimum necessary to prevent slip in the rotation direction at the time of normal operation of a rotary press where a large force is not acting on contact sections of the inner tube of the paper roll and a support member for supporting the paper roll, not only is the durability of bearings of rotation sections of the respective support members improved, but also overall durability of a paper roll support device completely containing support means is also improved.

(3) Also, with the invention disclosed in claim 3 of this application, since the pressure change assigning means has fluid pressure setting means capable of changing, among two magnitudes of pressure to be assigned to at least one support means, at least the smaller pressure setting, it is possible to change settings by adjusting pressure in an axial direction to be assigned to a support member in response to differences in rotational inertia accompanying changes in weight of a paper roll, and it becomes possible to reduce the load conditions imposed on the paper roll support device. It is therefore possible to further improve the durability of the paper roll support device.